

Efficacy of in-situ rainwater harvesting techniques on soil water storage, run-off and maize (zea mays) performance in semi-arid areas of Central of Tanzania

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Abstract

In the semi-arid zones of Central Tanzania, crops are grown in a stressful environment with lack of predictable soil water supply and this can be singled out as most critical environmental factor affecting crop production apart from low inherited soil fertility status and continued use of low yielding crop varieties. Low soil moisture supply for crop production in this semi-arid zone is further aggravated by in-appropriate tillage practices which accelerate rain water loss through increase runoff. During 2013/2014 – 2015/2016 cropping seasons, on-farm experiment was set up in marginal areas of Mlali village, Kongwa District in Central Tanzania to investigate the effect of insitu rainwater harvesting techniques on maize crop performance, surface runoff and soil water storage to pave way for sustainable cropping intensification. The study consisted of three tillage methods namely: ox-plough (FC) i.e. local tillage practice, ox-ripping (RT) and conventional tied ridging (TR), arranged in Randomized Complete Block (RCBD) design with three replicates. Findings revealed that consistently across season, in-situ rainwater harvesting techniques significantly ($P<0.05$) affected soil water storage, runoff and maize productivity. Soil water content monitored at vegetative, flowering and grain filling stages varied between 6.5 % by volume ($0.065 \text{ m}^3 \text{ m}^{-3}$) for FC and 16 % by volume ($0.16 \text{ m}^3 \text{ m}^{-3}$) for tied ridging. Higher volumetric water content under TR is attributed to the prolonged period of ponding water in the created micro-basins. The micro-basins also contributed to the significant ($P<0.05$) reduction in surface runoff by four folds when compared with FC, following the trend $\text{TR}<\text{RT}<\text{FC}$. Maize grain yield increments were at an average of 1222 kg/ha (77%) and 704 kg/ha (48.2 %) for TR and RT methods respectively. In view of ever increasing frequency and magnitude of agricultural droughts in this region, introduction of in-situ rainwater harvesting techniques notably tied ridging and ripping techniques were superior over ox-plough tillage and therefore is envisioned to bridge crop water deficit during dry spells, impart stability on household food security for majority of smallholder farmers, and minimise degradation of the natural resource base.

Key words: Semi-arid, Central Tanzania, In-situ rainwater harvesting, runoff, volumetric Water Content

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